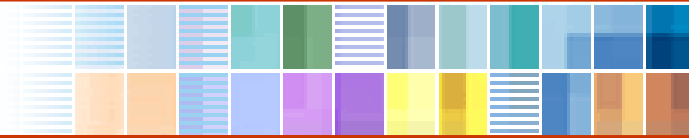# EnergyWorks: Park City Mall

Electric Distribution Transformation Program
Department of Energy Peer Review

October 28 – 30, 2003
San Diego, California

Introduction: Skip Trimble, EnergyWorks

Energy Services Hub: Sunil Cherian, Spirae

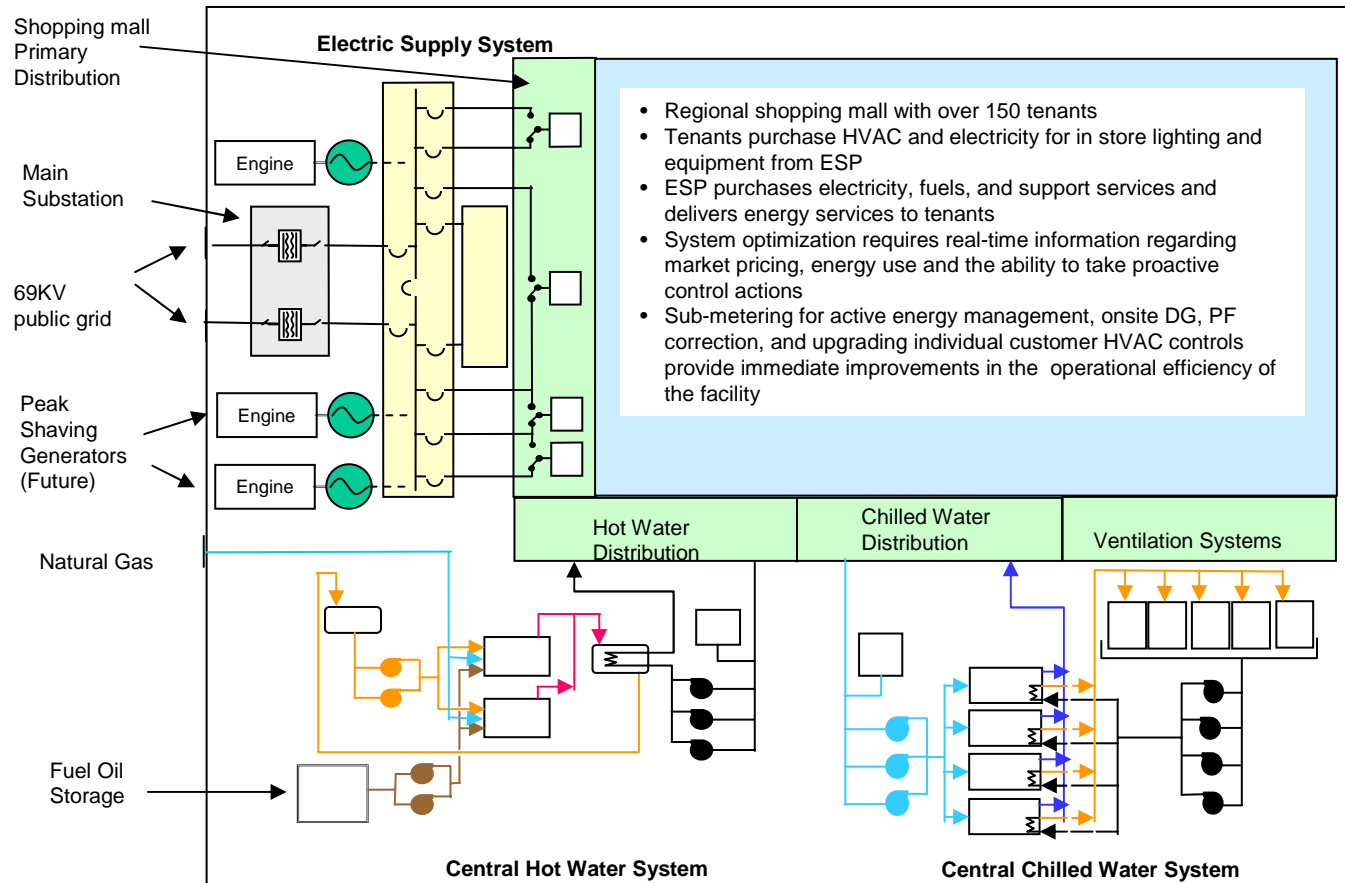Technology Architecture: Nicholas Noecker, IBM

Introduction: Commercial Opportunity
Skip Trimble, EnergyWorks

Program Objectives…

- Wholesale Interconnection
  - 69 kV, DSR, PJM Data, eSchedule
- Remote Monitoring & Control of ESP Operations
  - including bidding, scheduling and settlement processes
- Remote Monitoring & Control of GenSet
- Data Security
- Multi-vendor modularity
- Market Evaluation Process and Decision Capabilities
- Automated DG Dispatch

Diagram of EnergyWorks Park City facilities

Shopping mall Primary Distribution

Electric Supply System

Main Substation

69KV public grid

Peak Shaving Generators (Future)

Natural Gas

Fuel Oil Storage

Engine

- Regional shopping mall with over 150 tenants
- Tenants purchase HVAC and electricity for in store lighting and equipment from ESP
- ESP purchases electricity, fuels, and support services and delivers energy services to tenants
- System optimization requires real-time information regarding market pricing, energy use and the ability to take proactive control actions
- Sub-metering for active energy management, onsite DG, PF correction, and upgrading individual customer HVAC controls provide immediate improvements in the operational efficiency of the facility

Hot Water Distribution

Chilled Water Distribution

Ventilation Systems

Central Hot Water System

Central Chilled Water System

EnergyWorks—Long term Business Objectives

Standardized approach for

- Delivery of customized energy service solutions to end-users
- Operation and management of large numbers of DER assets
- DER aggregation and integration
- Interfacing with many suppliers and co-providers

Performance requirements

- Flexible end-user participation
- Scalability across diverse and geographically dispersed customer base
- Real-time response to customer and market conditions
- Low/no cost for small-scale transactions

We've assembled a multi-vendor Program Team to accomplish our objectives

Two Commercial opportunities were chosen by the team for Phase 1 and success criteria were defined

Commercial opportunities…

1. Make generation/Buy energy process – "Make/Buy"
2. Demand side response process

Success criteria…

- ✓ Capture Market Price Information
- ✓ Read GenSet Status Information
- ✓ Capture RT Demand & Develop Accurate Forecasts
- ✓ Develop Automated Make/Buy Decision Process
- ✓ Automatically Engage Generators when Necessary

High-level Project Plan

Phase I Activities	Week	1-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20	21-22	23-24
1. Requirements specification		▓	▓										
2. Conceptual design			▓	▓									
3. Proof-of-design test plan				▓	▓								
4. Interface requirements						▓							
5. Detailed design					▓	▓	▓	▓					
6. Proof-of-design Implementation							▓	▓	▓	▓	▓		
7. Phase II proposal and plan												▓	
8. Phase I final report													▓

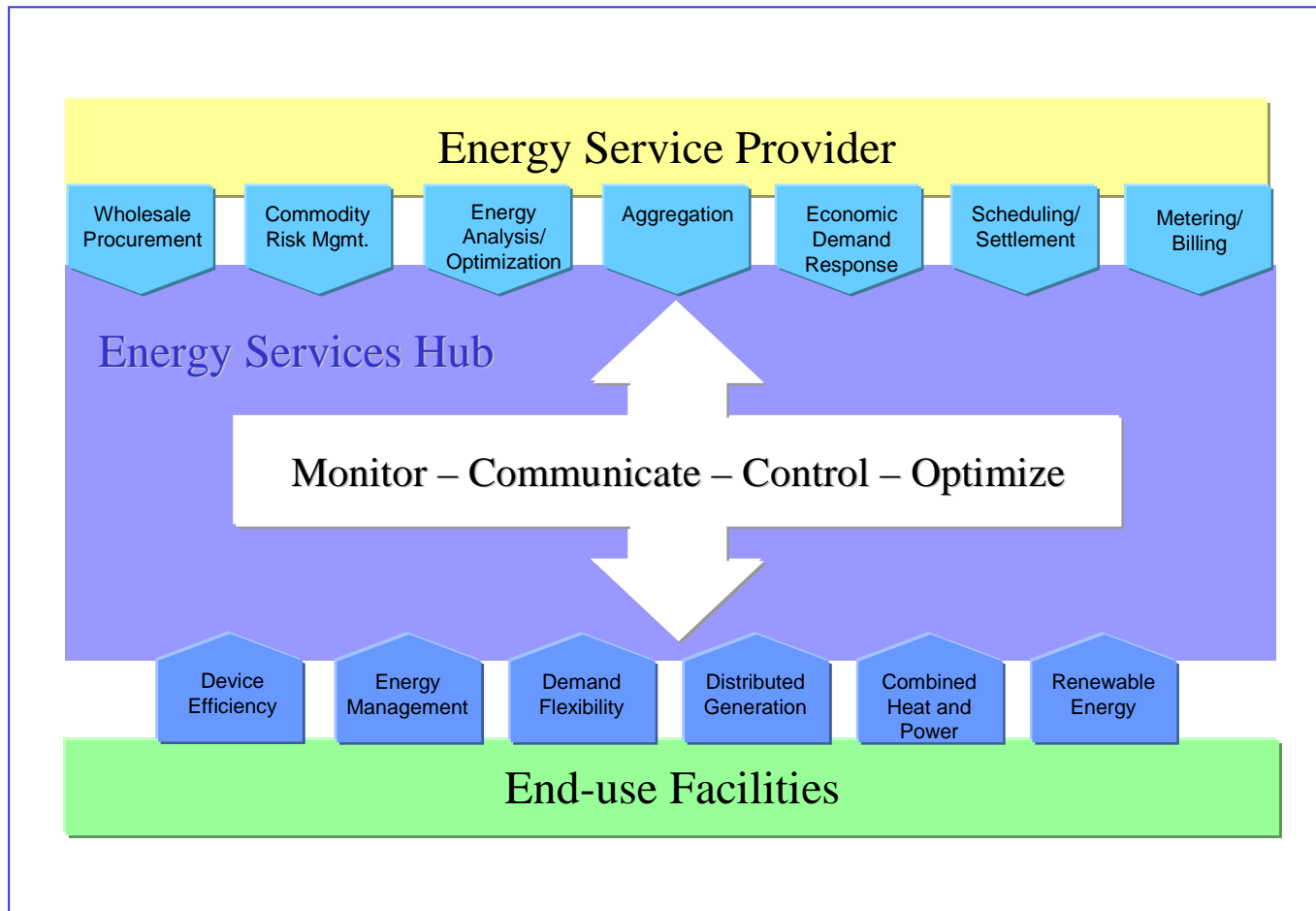# Future potential has been identified from our project

- Homeland Security implications
- Insurance Products *(financial and physical)*
- Additional Control Area Support *(e.g. black start and ancillary services)*
- New Optimization of Micro-Grids
- State and RTO Initiatives *(DG and DR)*
- End User Market Participation
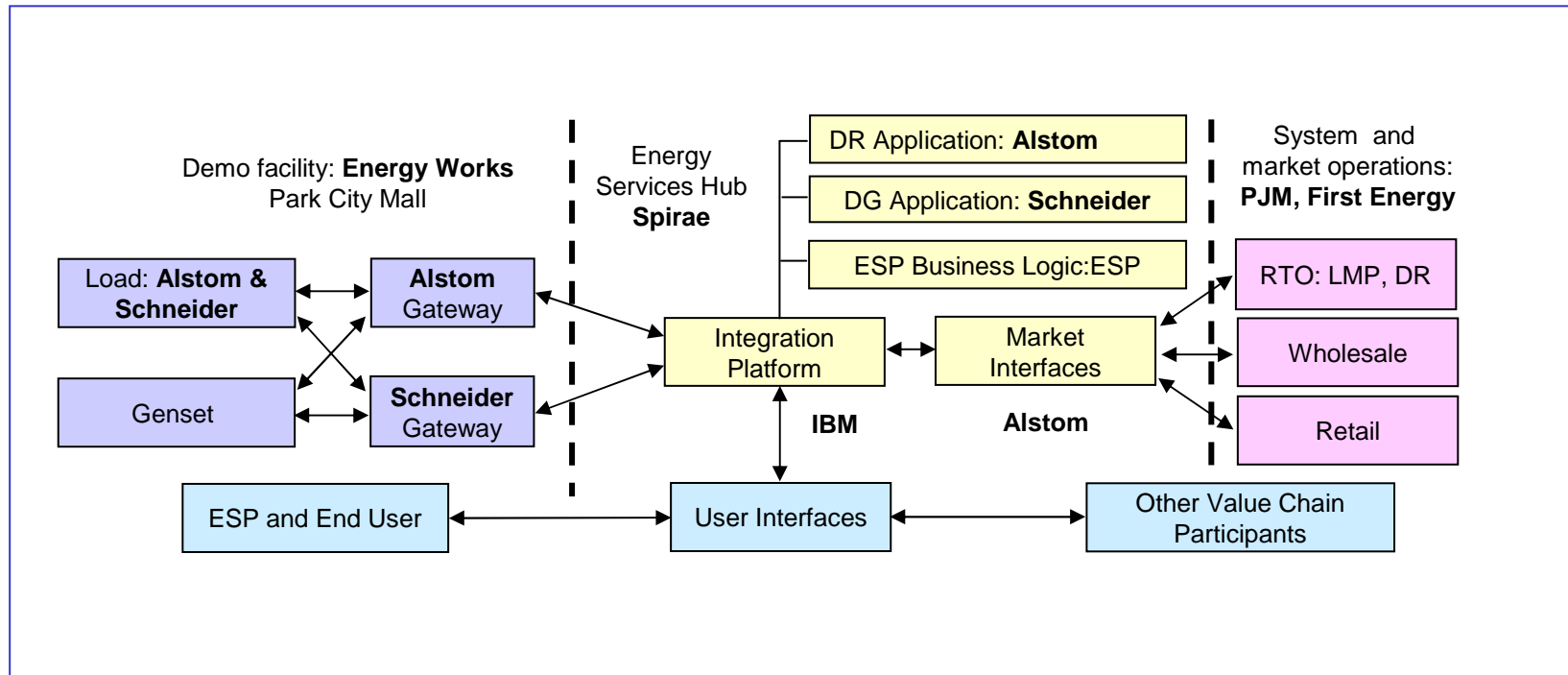
The Energy Services Hub (ESH)
Sunil Cherian, Spirae

An integration and optimization platform that interfaces with commodity suppliers, system operators, energy service providers, end-use customers, and energy management systems, providing a seamless foundation for cost-effectively implementing best practices in energy procurement, management, and optimization.

Energy Service Hub Conceptual

Energy Service Provider

| Wholesale Procurement | Commodity Risk Mgmt. | Energy Analysis/ Optimization | Aggregation | Economic Demand Response | Scheduling/ Settlement | Metering/ Billing |

Energy Services Hub

Monitor – Communicate – Control – Optimize

| Device Efficiency | Energy Management | Demand Flexibility | Distributed Generation | Combined Heat and Power | Renewable Energy |

End-use Facilities

Project model describing the linkages of facilities infrastructure to business systems

Demo facility: **Energy Works** Park City Mall

Energy Services Hub **Spirae**

System and market operations: **PJM, First Energy**

- Load: **Alstom & Schneider**
- **Alstom** Gateway
- Genset
- **Schneider** Gateway
- ESP and End User

- DR Application: **Alstom**
- DG Application: **Schneider**
- ESP Business Logic:ESP
- Integration Platform
- Market Interfaces
- User Interfaces

IBM   **Alstom**

- RTO: LMP, DR
- Wholesale
- Retail
- Other Value Chain Participants

PLC

EGX

IBM Inter-enterprise
Business Integration tools

Spirae ESH-Business
Process Automation

Meters

EnergyWorks Business
Processes for System
Optimization

Schneider/SquareD
Transparent Ready Devices

PJM eData feed (real time pricing)
Demand Response Markets

Alstom Market and
Portfolio Mgmt. Software

Spot power purchase

Mkt Specific Market Mgt	Trade Management	Asset Portfolio Optimization	Generation Management	Real-Time Control

Common UI	Common Services	Communication Protocols
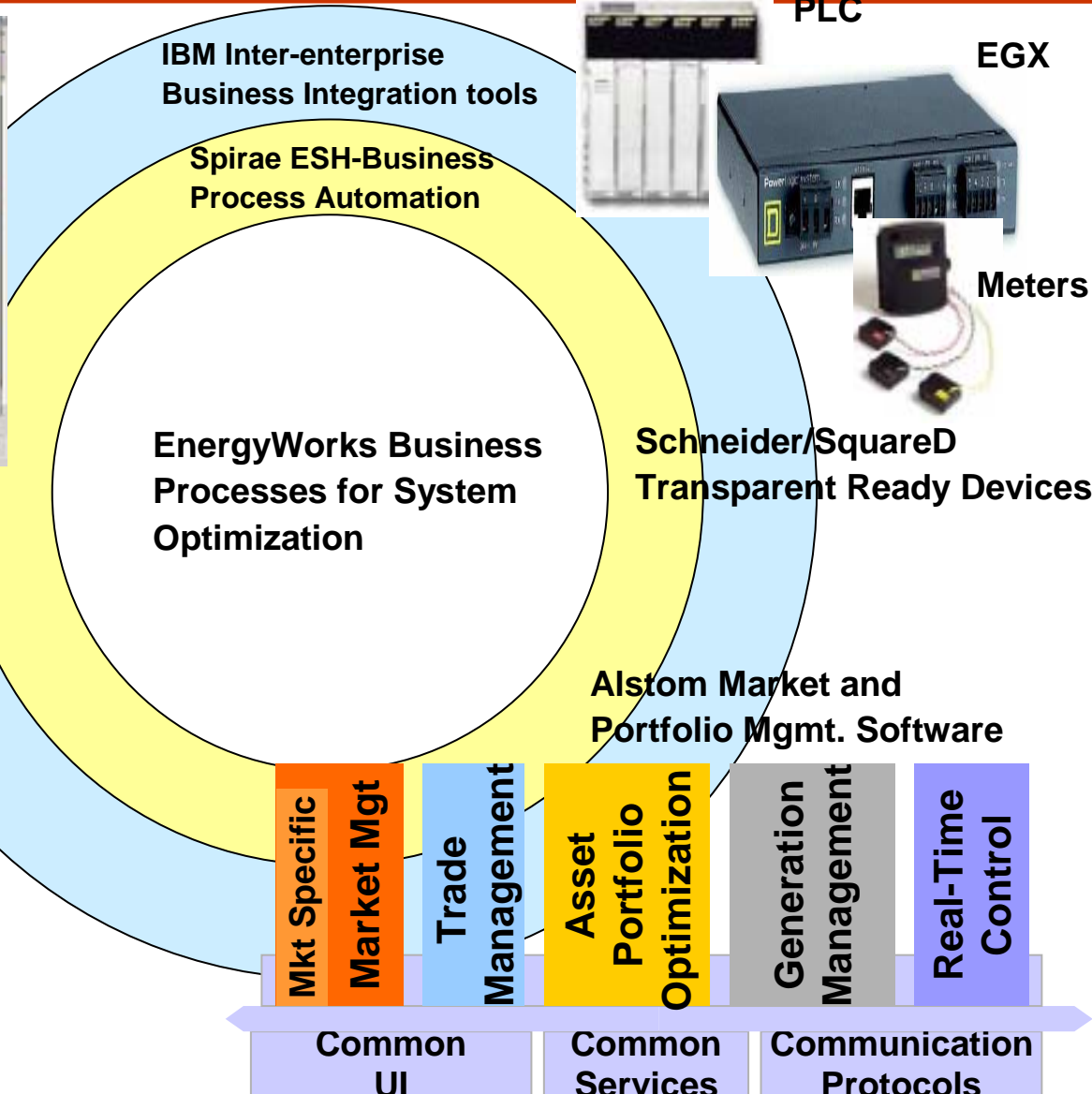
Business process flow diagram describing the automated Make/Buy process
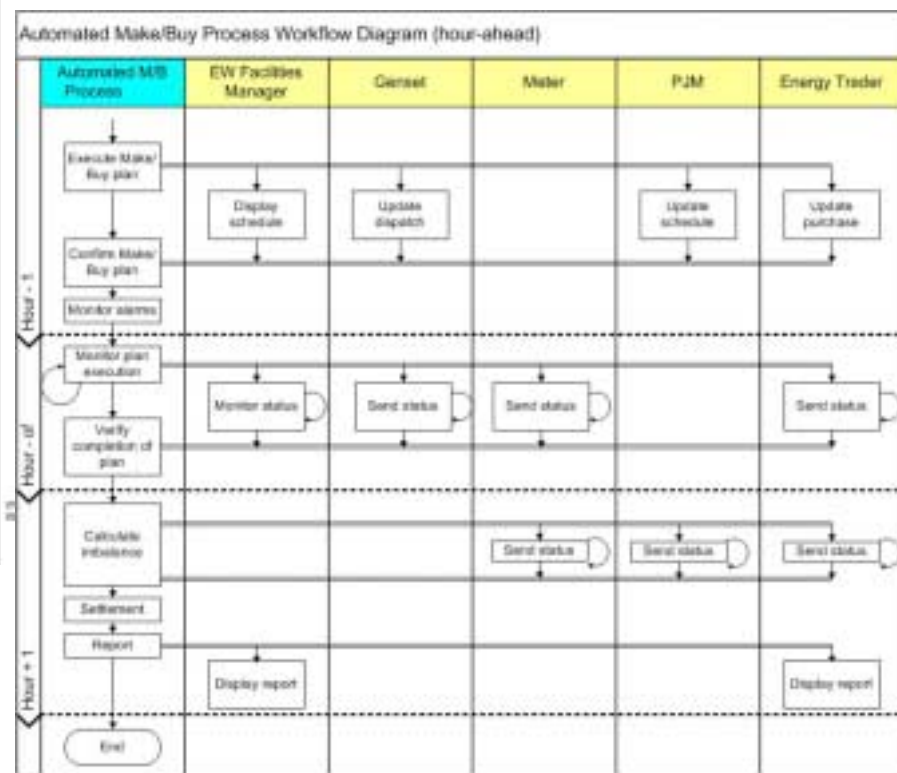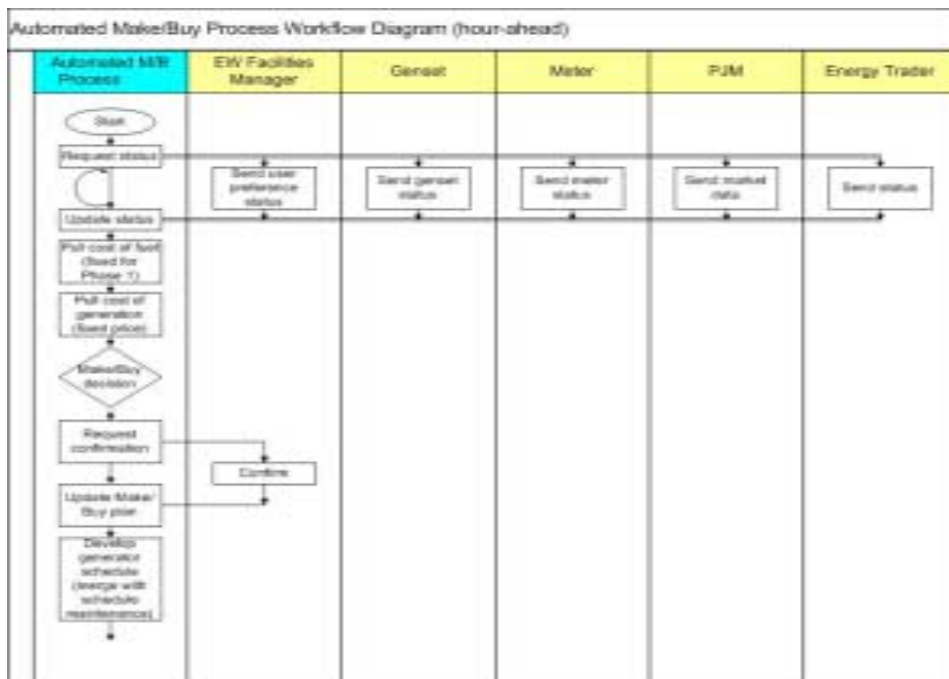
Technology Architecture
Nick Noecker, IBM
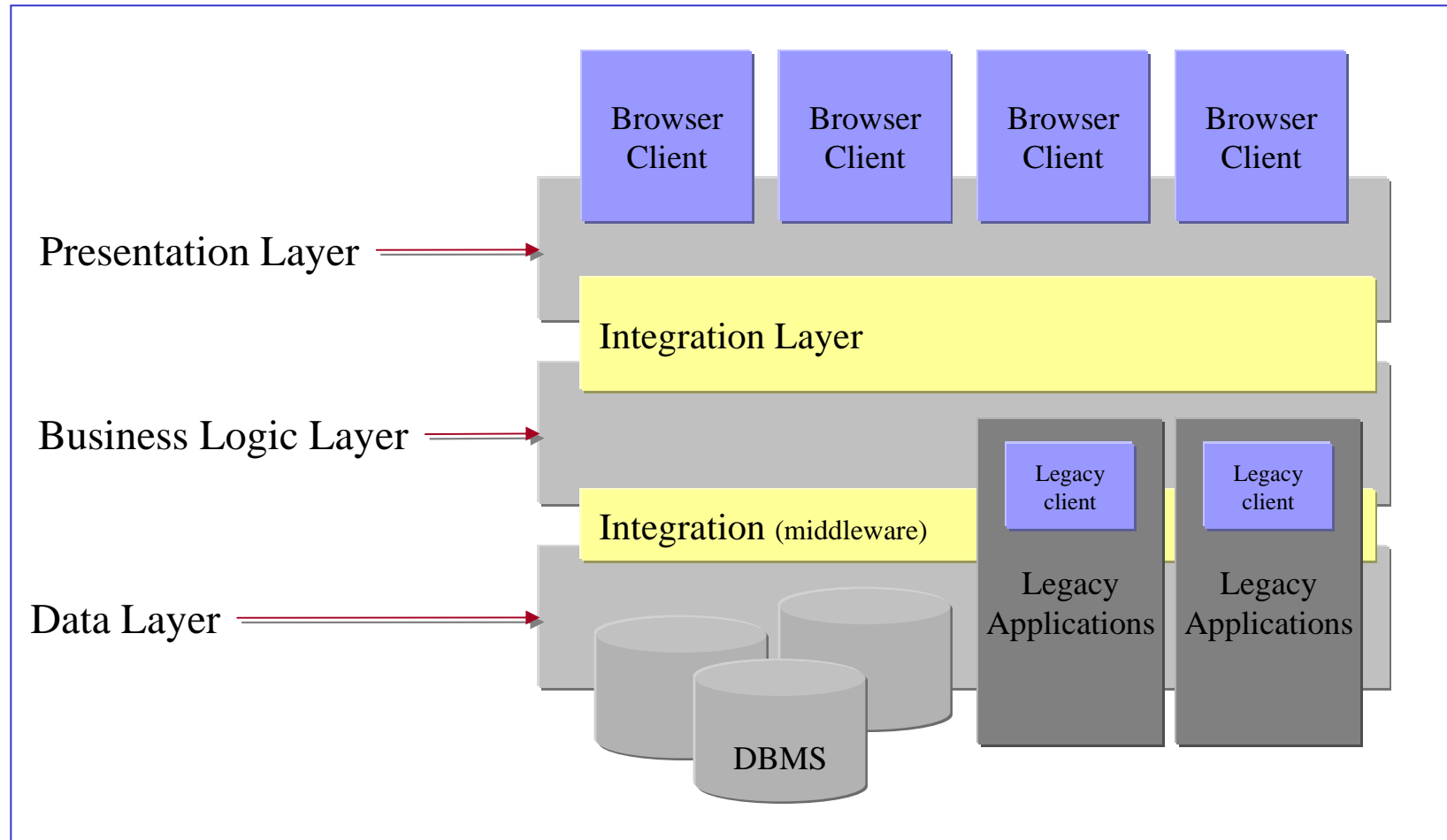
Guiding Principles…

1) Should be flexible – multi-platform compatibility
2) Must be scalable – be deployable & usable in the real world
3) Must be Secure-able – pragmatic
4) Leverage existing technologies, but invent when it advances our objectives
5) Be appropriate to the task at hand – keeps our eye on the ball
6) Should expose something new – advances-the-ball in a compelling way (e-business control loops)
7) Approach should be n-tier and loosely-coupled
8) Should accommodate a wide spectrum of user access
9) Budget constraints will be considered when designing the system
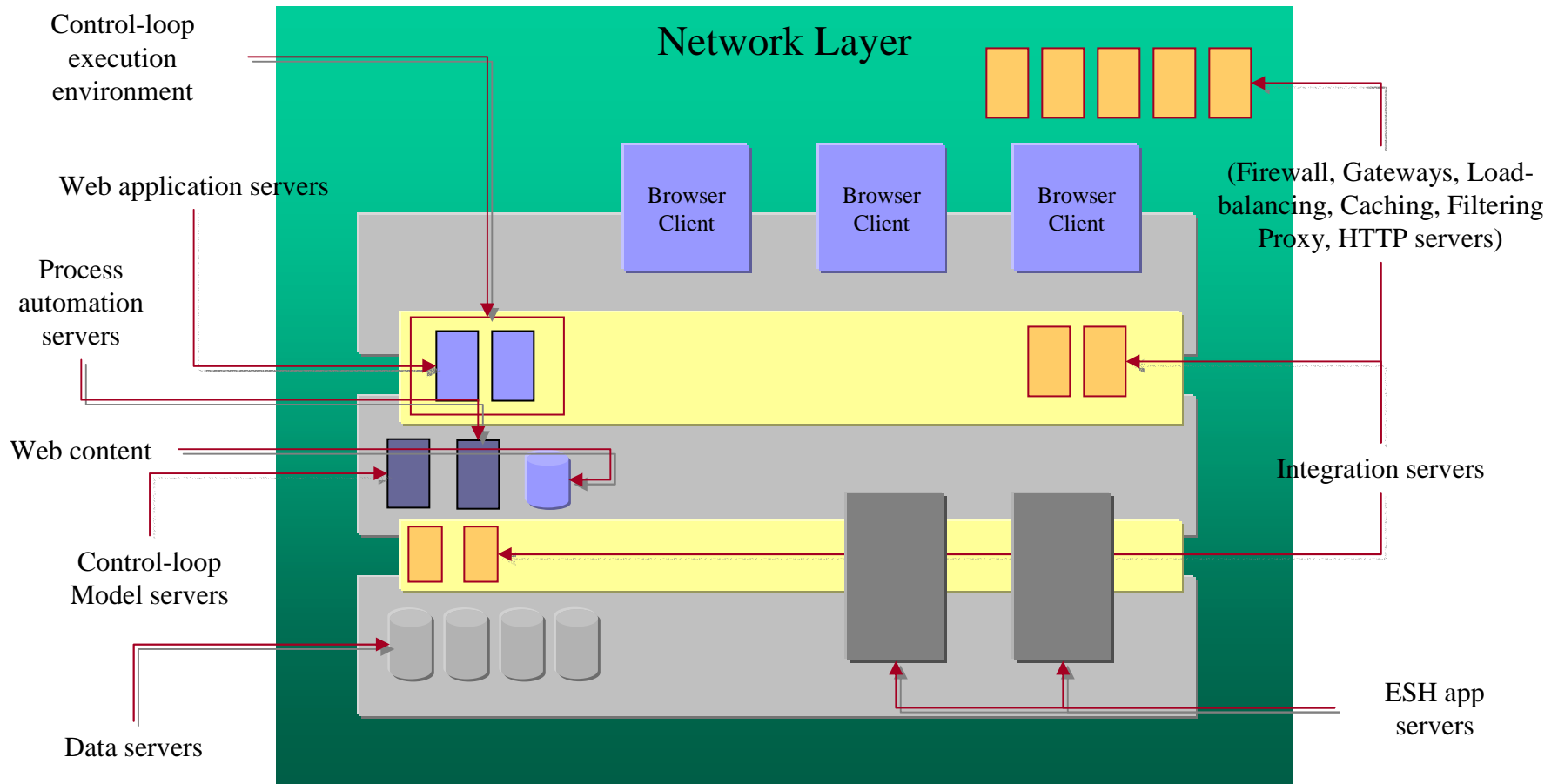10) Architectural pattern is *e-business*

Our strategy is to connect the electricity infrastructure to e-business systems then develop software-based control models that monitor and automate business process, starting with "Make/Buy"
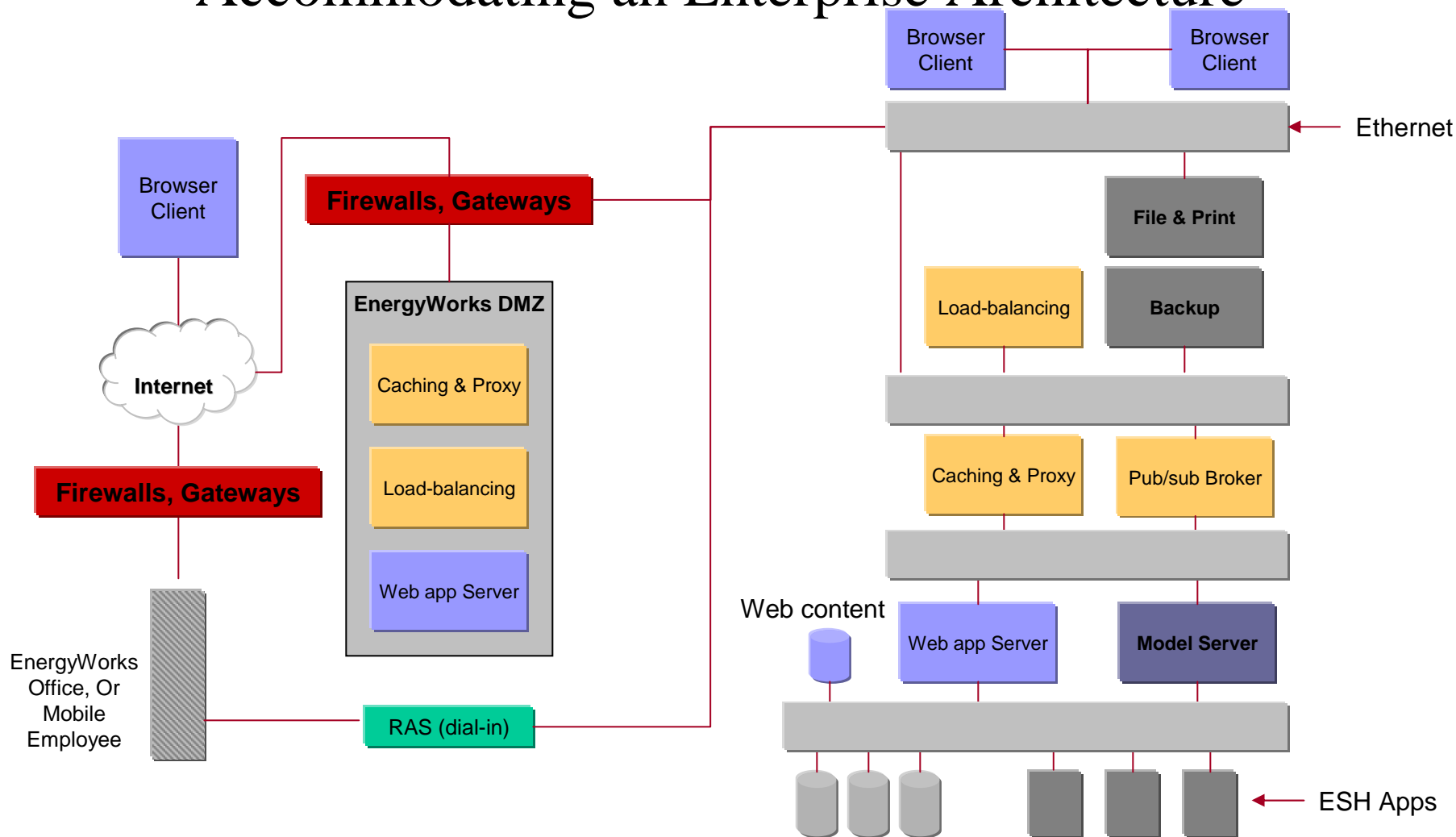

Make/Buy e-business control loop

Markets   ISO/RTO   Customers   Suppliers

Grid   Distributed Energy Resources   Facilities
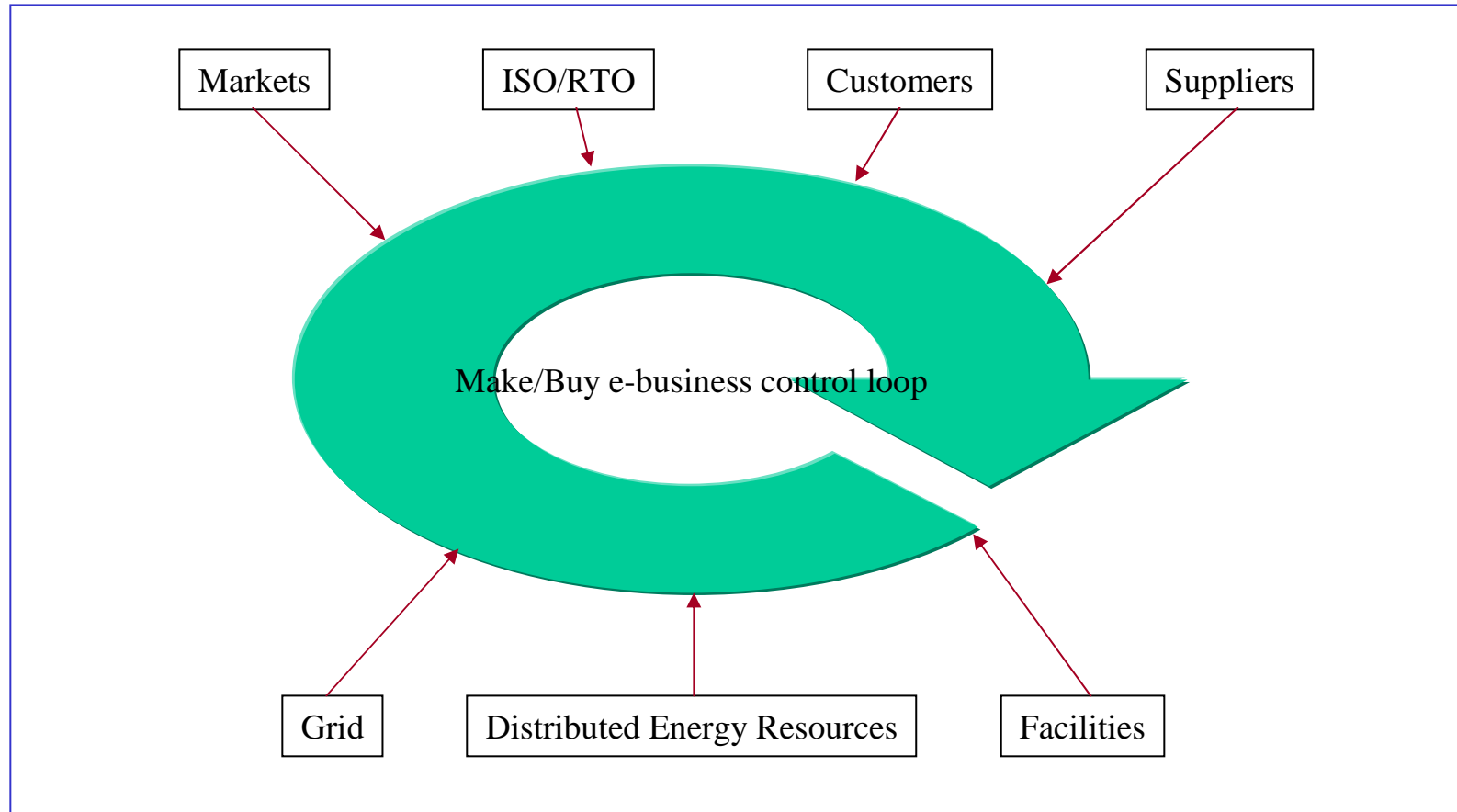
Project Architecture: n-tier, web-enabled, legacy-enabled

Presentation Layer

Browser Client | Browser Client | Browser Client | Browser Client

Integration Layer

Business Logic Layer

Integration (middleware)

Legacy client | Legacy client

Data Layer

DBMS

Legacy Applications | Legacy Applications

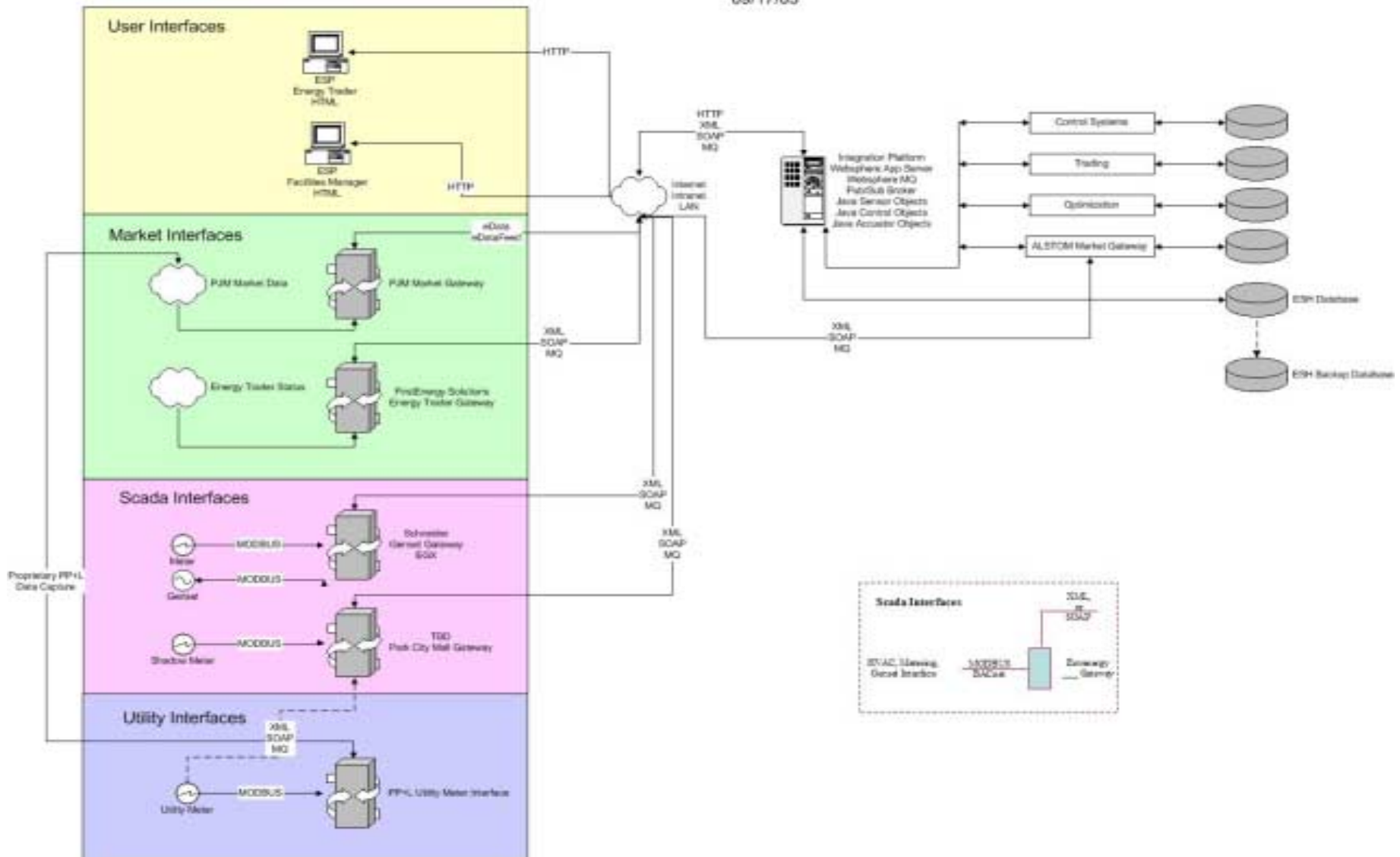# Location of program system components

Accommodating an Enterprise Architecture

EnergyWorks Project Implementation Diagram
Phase 1
09/17/03

Project Summary

Highlights
- On Schedule and within Budget
- Team working exceptionally well together
- Phase I Testing to be completed by mid-December
- Phase II plans currently under development

Well on track to achieve DOE Objectives:
- Wholesale Interconnection (69 kV, DSR, PJM Data, eSchedule)
- Remote Monitoring & Control of ESP Operations
- Remote Monitoring & Control of GenSet
- Data Security
- Multi-vendor interoperability
- Market Evaluation Process and Decision Capabilities
- Quantification of value

— Q&A —